

WHAT IS CLAIMED IS:

1. A method for controlling the dispatch of data on a telecommunication network, the method comprising:
  - 5 receiving one or more data streams at an interface on the telecommunication network;
  - accumulating data from the one or more data streams for each of a plurality of outgoing channels;
  - upon the accumulation of a threshold amount of data for one of the outgoing channels, dispatching the accumulated data;
  - 10 if there is no accumulated data for an outgoing channel then upon the receipt of data for that outgoing channel which is not dispatched immediately, scheduling an expiry time for the outgoing channel and associating the outgoing channel with the expiry time; and,
  - 15 when the expiry time occurs, using the association to identify a group of one or more outgoing channels associated with the expiry time and, for the outgoing channels in the group, sending the accumulated data.
- 20 2. The method of claim 1 wherein associating the outgoing channel with the expiry time comprises placing information identifying the outgoing channel in a list associated with the expiry time.
- 25 3. The method of claim 2 wherein the list is a linked list and associating the outgoing channel with the expiry time comprises placing a pointer to a record associated with the outgoing channel into the linked list.

4. The method of claim 2 comprising, upon dispatching the accumulated data for an outgoing channel before the expiry time, deleting from the list the association of the outgoing channel with the expiry time.
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5. The method of claim 4 wherein the list comprises a doubly-linked list and deleting from the list the association of the outgoing channel with the expiry time comprises retrieving information identifying a previous outgoing channel in the doubly linked list and a next outgoing channel in the doubly linked list from a record associated with the outgoing channel.,,
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6. The method of claim 1 wherein dispatching the accumulated data comprises dispatching one or more fixed-size cells.
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7. The method of claim 6 wherein the threshold amount of data is an amount of data required to fill one of the fixed-size cells.
8. The method of claim 7 wherein data for each outgoing channel is carried by a connection on an ATM telecommunication link and the fixed-size cells are ATM cells.
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9. The method of claim 8 wherein receiving a plurality of data streams at an interface comprises receiving data frames at the interface and accumulating data destined for each of the plurality of outgoing channels comprises encapsulating the data frames for an outgoing channel according to an ATM adaptation layer protocol.
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- 30 10. The method of claim 1 wherein dispatching the accumulated data comprises sending one or more variable-size packets.

11. The method of claim 10 wherein the threshold amount of data is less than a maximum amount of data capable of being carried by one of the variable-size packets.
- 5    12. The method of claim 10 wherein the threshold amount of data is equal to a maximum amount of data capable of being carried by one of the variable-size packets.
- 10    13. The method of claim 1 comprising providing a CU timer memory comprising a plurality of locations, each of the locations corresponding to a possible expiry time wherein associating the outgoing channel with the expiry time comprises associating a record associated with the outgoing channel with one of the locations in the CU timer memory corresponding to the expiry time for the outgoing channel.
- 15    14. The method of claim 13 wherein associating a record associated with the outgoing channel with one of the locations in the CU timer memory comprises placing a pointer to the record in the one of the locations in the CU timer memory.
- 20    15. The method of claim 1 wherein the method comprises providing a CU timer memory comprising a plurality of locations, each of the locations corresponding to a possible expiry time wherein associating the outgoing channel with the expiry time comprises placing a pointer to a record associated with the outgoing channel into a linked list associated with one of the locations in the CU timer memory corresponding to the expiry time.
- 25    16. The method of claim 15 wherein using the association to identify a group of one or more outgoing channels associated with the

expiry time comprises traversing a linked list beginning at the location in the CU timer memory corresponding to the expiry time.

- 5 17. A method for controlling the transmission of fixed-sized data cells on a telecommunication link, the method comprising:  
receiving one or more data streams at an interface to the telecommunication link;  
assigning data from the data streams into fixed-size cells for  
10 transmission across connections in the telecommunication link;  
upon the creation of a partially-filled cell to be transmitted on a connection, scheduling an expiry time for the partially-filled cell and associating the connection with the expiry time; and,  
when the expiry time occurs, using the association to  
15 identify a group of one or more connections for which there are partially-filled cells all associated with the expiry time and dispatching the partially-filled cells in the group.
18. The method of claim 17 wherein associating the connection with  
20 the expiry time comprises placing information identifying the connection in a list associated with the expiry time.
19. The method of claim 18 wherein the list is a linked list and  
associating the connection with the expiry time comprises placing  
25 a pointer to a record associated with the connection into the linked list.
20. The method of claim 17 wherein sending the partially-filled cells comprises providing an indication that the identified partially-filled cells should be transmitted without further delay.  
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21. The method of claim 17 comprising, upon filling a partially-filled cell before the expiry time, dispatching the cell and deleting the association of the connection with the expiry time.
- 5 22. The method of claim 21 wherein associating the connection with the expiry time comprises inserting a record identifying the connection into a doubly linked list associated with the expiry time and deleting the association of the connection with the expiry time comprises removing the record from the doubly linked list.
- 10 23. The method of claim 17 wherein the telecommunication link comprises an ATM link and the fixed-size cells comprise ATM cells.
- 15 24. The method of claim 17 comprising in a CU timer memory having areas corresponding to each of a plurality of possible expiry times associating the connection with the expiry time by placing information identifying the connection into an area in the CU timer memory corresponding to the expiry time.
- 20 25. The method of claim 24 wherein placing information identifying the connection into an area in the CU timer memory comprises placing a pointer to a head of a list of one or more records, including a record associated with the connection, into the area in the CU timer memory corresponding to the expiry time.
- 25 26. The method of claim 25 wherein the list comprises a linked list.
- 30 27. The method of claim 24 wherein using the association to identify a group of one or more connections having partially-filled cells all associated with the expiry time comprises traversing a linked list

beginning at the location in the CU timer memory corresponding to the expiry time.

- 5        28. The method of claim 27 comprising maintaining a record for each of the plurality of connections wherein the record comprises a field capable of holding a pointer to a next one of the records and traversing the linked list comprises retrieving from the location in the CU timer memory a pointer to a first record associated with a first connection and retrieving from the field of the first record a pointer to a second record associated with a second connection having the same expiry time.
- 10      29. The method of claim 17 comprising maintaining a CU timer memory having a location associated with each of a plurality of possible expiry times wherein associating the connection with the expiry time comprises placing information identifying the connection into a list associated with the location in the CU timer memory corresponding to the expiry time.
- 15      30. The method of claim 29 wherein the list comprises a linked list.
- 20      31. The method of claim 30 wherein the linked list comprises a doubly-linked list.
- 25      32. Apparatus for forwarding data packets belonging to a plurality of outgoing channels, each outgoing channel carrying data from one or more streams of data, over a telecommunication link the apparatus comprising:  
                a outgoing packet assembler connected to place data packets onto the telecommunications link and a combined use timer connected to control the transmission of partially-filled data
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packets over the telecommunications link, the outgoing packet assembler being configured to provide a partial packet ready signal to the combined use timer upon the creation of a partially-filled data packet containing less than a threshold amount of data;

- 5                         the combined use timer comprising a timer maintaining a current time value, a calculator connected to determine an expiry time for a partially-filled packet corresponding to a partial packet ready signal, a data structure capable of holding information identifying groups of partially-filled packets which share a common expiry time and comparison logic connected to signal to the outgoing packet assembler when the expiry time for a group of one or more partially-filled packets which share a common expiry time has occurred.
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- 15     33. The apparatus of claim 32 wherein the data packets comprise fixed-size cells.
- 20     34. The apparatus of claim 33 wherein the threshold amount of data is an amount of data equal to a data payload of one of the fixed-size cells.
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35. The apparatus of claim 32 wherein the outgoing packet assembler is connected to provide a packet sent signal when a previously created partially-filled packet is transmitted and the combined use timer comprises means for removing reference to the previously created partially-filled packet from the data structure in response to the packet sent signal.
- 30     36. The apparatus of claim 28 wherein the outgoing packet assembler is connected to provide a packet sent signal when a previously created partially-filled packet is transmitted and the combined use

timer comprises means for inhibiting the comparison logic from generating a signal relating to packets for which packet sent signals have been received.

- 5    37. The apparatus of claim 32 wherein the data structure comprises a plurality of lists, one of the lists corresponding to each of a plurality of possible expiry times.
- 10    38. The apparatus of claim 37 wherein the lists comprises linked lists.
- 15    39. The apparatus of claim 38 wherein the linked lists comprise doubly linked lists.
- 20    40. The apparatus of claim 39 comprising an interface system comprising control logic, a memory holding a plurality of records, the records containing information regarding states of each of the plurality outgoing channels and a working memory wherein the control logic is configured to load into the working memory a current one of the records.
- 25    41. The apparatus of claim 40 wherein each of the records comprises a previous connection in list field capable of holding a pointer identifying a previous record in one of the doubly-linked lists and a next connection in list field capable of holding a pointer identifying a next record in the doubly linked list, each of the doubly linked lists comprises a set of zero or more records, and the records in any of the sets comprising two or more of the records are linked by pointers in their next connection in list and previous connection in list fields.

41. The method of claim 41 comprising means for encapsulating received data according to an ATM adaptation layer protocol prior to placing the received data into the fixed-sized data packets.

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42. The apparatus of claim 32 comprising a CU timer memory comprising a plurality of locations, each of the locations corresponding to a possible expiry time, each of the locations associated with a set of zero or more of the outgoing channels which have partially filled packets having expiry times matching the possible expiry time of the location.

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43. The apparatus of claim 43 wherein each of the locations in the CU timer memory is capable of holding a pointer identifying a record corresponding to a outgoing channel in a set of the outgoing channels which have partially filled packets having expiry times matching the possible expiry time of the location.

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44. The apparatus of claim 32 wherein the threshold is smaller than a maximum data payload of one of the data packets.

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45. The apparatus of claim 32 wherein the threshold is equal to a maximum data payload of one of the data packets.

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